urticæ was one of the stages. Details of the experiments are given, and Schrœter concludes that *Æcidium urticæ* is a stage of *Puccinia caricis*. In a note to his paper, Dr. Schrœter mentions that Dr. Magnus, of Berlin, has made similar experiments with the same result, an important confirmation of the remarkable habit these curious plants have of changing from one host to another, and at the same time changing the form of their spores, a condition described by De Bary long ago in the rust of wheat. A second form noticed by our author is a species of rust common on many grasses. It has many names, and Dr. Schrœter calls it *Uromyces dactylidis*, Ottli, (*Uromyces graminis*, Cooke). One stage is spent in our common grasses, such as *Dactylis glomerata*, *Poa nemoralis*, *P. trivialis*, *P. annua*, *P. pratensis*, &c. The other stage occurs on *Ranunculus bulbosus*, *R. repens*, and *R. polyanthemos*, and is known as *Æcidium Ranunculacearum*, D.C. The Æcidia occurring in other Ranunculaceæ (*Clematis*, *Thalictrum*, &c.) seem to belong to other species. Dr. L. Just's paper is a physiological one, showing the effect of the epidermis of the apple in preventing loss of water by transpiration. The third paper, by Dr. J. Schrœter, on the effect of disinfectants in lower organisms, shows markedly the value of carbolic acid in destroying germs. In the fourth paper Dr. A. B. Frank shows how light influences the relative time of development of the flowers in a catkin, those flowers opening first which receive the most light. Next follow two papers by Dr. Ferdinand Cohn, one on the "Function of the Bladders of Aldrovanda and Utricularia," the other on the "Development of the genus Volvox." English readers are already acquainted with the more important facts recorded in the first paper, as they have already been made use of by Mr. Darwin in his work on "Insectivorous Plants." The second paper is of especial interest in relation to the re-distribution of the Thallophytes, by Prof. Sachs, in the fourth edition of his justly celebrated "Lehrbuch." The structure of volvox is carefully described, and its modes of reproduction both sexual and non-sexual. The non-sexual reproductive cells Cohn calls Parthenogonidia. Non-sexual reproduction seems to take place during the whole year, and the alternation of generations is completed by the occurrence of sexual reproduction in the spring. The volvox-colony, or cænobium, is either monœcious or diœcious, the female cells, or Gynogonidia are either produced along with the male cells, or Androgonidia, in the same colony, or they are not. Cohn proposes to divide the Linnæan Volvox globator into two sub-species, namely, (*a*) *Volvox monoicus*, and (*b*) *Volvox dioicus*, the former having both andro- and gynogonidia, the latter either one or other. The structure of Volvox is very like that of Pandorina, but the reproduction is like that of Sphaeroplea, and it belongs, not to the Zygosporeæ, which have conjugating zoospores, but to the Oosporeæ. Cohn, however, does not consider the Zygosporeæ and Oosporeæ to be separate classes of the Thallophyta, but only to be subdivisions of one class, to which he gives the name of Gamosporeæ. The next division Cohn calls the Gamocarpeæ, a division quite equivalent to Sachs' Carposporeæ. In the Gamocarpeæ there are two methods of fertilisation. One by means of the Pollinodium, analogous to the conjugation in the Gamosporeæ, the other by Spermatia, resembling the Spermatozoids. In the higher plants a somewhat similar arrangement exists; the Muscineæ and Vascular Cryptogams having Spermatozoids, while the flowering plants have pollen and pollen-tubes, showing a certain analogy to the pollinodium of some of the Carposporeæ.

Dr. Richard Sadebeck contributes a paper on the remarkable parasite living in the cells of the prothallium of Equisetum, and called *Pythium equiseti*. It belongs to the Oosporeæ, and its structure and life-history is here well described.

The part concludes with two papers, "Researches on Bacteria," Parts II. and III. The first is by Dr. Cohn, and is a continuation of his paper with the same title in the second part of the "Beiträge," while the other is by Dr. Eduard Eidam. In the latter paper Dr. Eidam gives details of a series of very interesting researches on the action of different degrees of temperature and of drying on Bacterian Termo. The Bacteria were cultivated in Prof. Cohn's normal nutrient fluid, and the solution kept at definite temperatures for definite periods of time. The activity of Bacteria does not begin until the temperature rises above + 5° C. + 5½°, being the temperature at which they begin to multiply, although very slowly. Between 30° and 35° C. the multiplication is most rapid, but at 40° the activity again diminishes, and the Bacteria in the nutrient fluid are killed by exposure for fourteen hours to a temperature of 45° C., or for three hours at a temperature of 50° C. When dried the Bacteria can retain their vitality for a long time at high as well as at low temperatures. All these experiments are of especial interest at the present time and seem to have been conducted with great care. Prof. Cohn's paper deals chiefly with descriptions of new or imperfectly known genera and species, and concludes with an attempt at grouping the different genera of Bacteriaceæ according to their natural affinities. The close relation of Bacteria to the Phycochromaceæ is pointed out, and it is shown to be impossible to erect the Bacteriaceæ into a family separate from the Phycochromaceæ. Naegelis' name of Schizomycetes is objected to on the ground that Bacteria are not fungi, and the term Schizophyta proposed for the group instead. This group is nearly equivalent to and would take the place of Sachs' first class of Thallophyta, namely, the Protophyta. The Schizophyta includes two tribes: (1) Glœogenæ, in which the cells are either free or united by gelatinous substance; and (2) Nematogenæ, which are filamentous. To the first tribe belong such genera as Chroococcus, Micrococcus, Bacterium, Aphanocapsa, Glœocapsa, Clathrocystis, Sarcina, Polycystis, &c.; while to tribe 2 belong Beggiatoa, Oscillaria, Vibrio, Spirulina, Anabæna, Nostoc, Rivularia, Cladothrix, Scytonema, &c. The paper is an exceedingly interesting one, and has most important bearings on the classification of the Thallophytes.

W. R. McNab

FERNET'S PHYSICS

Cours de Physique. Par É. Fernet. (Paris : G. Masson, Editeur, 1876.)

FROM the great success which attended the publication of Prof. Ganot's "Éléments de Physique," due in a great measure to the excellence of its illustrations, and followed as it was a few years later by the splendidly got up "Traité" of M. Deschanel, which has been so ably

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translated into English by Prof. Everett, there has been an almost continuous stream of works upon Physics from our neighbours across the Channel. French publishers of technical works appear to be of opinion that the production of a "Traité de Physique" is an indispensable part of their duty, and that their good name will suffer unless they bring one out. France is fortunately rich in physicists, so that there are always good men to be found to do the work. The result is that each Paris season introduces one or more new books upon Physics, which are in most cases well written, and generally abound with excellent illustrations.

The "Cours de Physique" of Prof. Fernet is at once both ably written and singularly incomplete. It is intended as a text-book for the *Classe de Mathématiques Spéciales*, and as such cannot altogether be classed with the books of which we have been speaking. It is written for a special purpose, and its value to the general student is much impaired thereby.

The chapters treating of the molecular construction and of the various forms of matter is a concise digest of the modern theories of this most speculative subject, and the definitions of the solid liquid and gaseous states of matter are particularly clear. On the other hand, no reference whatever is made to the all-important subject of gravitation, so that the laws of falling bodies and projectiles, centre of gravity, and even the pendulum itself, are necessarily cut out.

Again, hydrostatics is both fully and ably treated, the law of Archimedes and the determination of specific gravities being very clearly explained.

The whole subject of heat is confined to the expansion under its influence of solid, liquid, and gaseous bodies, which occupies one-fourth of the whole book. The reader looks in vain for some reference to the laws of freezing and evaporation or of conduction and specific heat. More extraordinary still is that the entire subject of radiant heat is conspicuous by its absence, no reference being made to diathermancy or to the reflection and refraction of heat, and the dynamical theory is ignored altogether.

In Optics the laws of reflection and refraction are more fully treated than any other subject in the book, the properties of mirrors and lenses of various forms being thoroughly and mathematically considered. No reference is, however, made to dispersion, and the question of colour is left out altogether, necessitating of course the omission of the important subject of spectra and of the Fräunhofer lines. Again, double refraction and all the phenomena connected with polarisation are not even alluded to, nor are the interesting subject of the velocity of light and the beautiful experiments of Foucault, of Fizeau, and of Cornu for its determination.

Acoustics is entirely left out, and statical electricity occupies but a short chapter, in which induction is fairly treated, and the various forms of electrical machines are well described.

What is perhaps the most remarkable omission of all is that of the entire subject of Electro-dynamics. No mention is made of the voltaic battery, of the great subject of electro-magnetism and the electric telegraph, of electrolysis or of induced currents as exemplified in the Ruhmkorff coil, neither are magneto-electricity or thermo-electricity referred to.

The only explanation offered for the omission of so important a branch of physical science in a "Cours de Physique" is the following foot-note to the chapter upon Statical Electricity :—

"By the rules for admission into the *École polytechnique* —which are identical with those for the *Classe de Mathématiques Spéciales*—candidates are required to possess an elementary knowledge of statical electricity and of magnetism only. The importance, therefore, of these two subjects in the present course does not admit of their being treated as fully as those in the preceding chapters. The further study of them must be reserved for the course in the *École*, where students are required to work up the subjects of both dynamic electricity and electro-magnetism."

We may assume from this note that the other omissions to which we have referred are due to the same regulations. It is difficult to understand how such rules can exist, or what considerations could have guided those who framed them when they required candidates for admission to read up statical electricity, leaving the more important subject of electro-dynamics alone, as well as the science of electro-magnetism, notwithstanding its important applications.

From what has been said it will be seen that Prof. Fernet's "Cours de Physique" is evidently a "cramming" book for students seeking admission to a particular class which has very exceptional requirements. For that purpose it is no doubt of value, but it is practically unavailable to the general student of Physics by reason of the number and the importance of its omissions.

THE CHEMISTRY OF LIGHT AND PHOTOGRAPHY

The Chemistry of Light and Photography in their Application to Art, Science, and Industry. By Dr. Hermann Vogel, Professor in the Royal Industrial Academy, Berlin. New and thoroughly revised edition, with 100 Illustrations. (London: H. S. King and Co., 1876.)

LAST year, in reviewing in the columns of NATURE this volume of the International Scientific Series, it became our duty to point out the very serious errors in chemistry with which the translation abounded.

We are happy to find that in this "new and thoroughly revised edition," the whole of the objectionable passages have been corrected, and that the same measure of correction has been extended to the English throughout, so that the work is now a very creditable translation. With regard to the author's share of the work, we can, on a re-perusal, recommend it as a thoroughly good *résumé* of the principal photographic processes, and we note that the very numerous variations of the photo-printing and lithographic processes have been very fully noted and their chief points described, for, although this description of what are, as a rule, trivial variations of one or two processes may seem useless, it cannot fail to call the reader's attention to some of the vagaries permitted by patent laws in various countries. We also notice that some considerable space has been given to astronomical photography (in connection with which we would note that the name of the eminent American astronomer who produced the negative of the moon from which the frontispiece of the book is taken is Rutherfurd, and not Rutherford, as

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